

## FORCES

**KINEMATICS-** The study of how things move.

**DYNAMICS-** The study of why things move.

**FORCE-** A push or pull on an object. A force is a vector quantity. Forces acting to the right are positive, to the left, negative.

### NEWTON'S FIRST LAW OF MOTION

Every object continues in a state of rest or of uniform motion in a straight line unless acted upon by an external unbalanced force.

This tells us that every object resists changes in its speed or direction of motion. This property of maintaining velocity unchanged is called **inertia**. Newton's first law is often referred to as the **law of inertia**.

**NEWTONS SECOND LAW OF MOTION**

An object that is acted on by an unbalanced force experiences an acceleration in the direction of the force. The acceleration varies directly with the force and inversely with the mass. It is summarized as:

$$F = ma$$

Where  $F$  = force (N)

$m$  = mass (kg)

$a$  = acceleration ( $\text{m/s}^2$ )

units:  $F = \text{kg} \times \frac{\text{m}}{\text{s}^2}$

$$\text{N} = \frac{\text{kgm}}{\text{s}^2}$$

**NEWTON'S THIRD LAW OF MOTION**

If object A exerts a force on object B, then object B exerts a force equal in magnitude but opposite in direction on object A.

$$F_{A \text{ on } B} = -F_{B \text{ on } A}$$

This clearly demonstrates that

1. forces always occur in pairs
2. each force of the pair acts on a different object
3. each force of the pair is equal in magnitude but acts in the opposite direction to each other

A shortened version of the third law is:

**For every action there is an equal and opposite reaction.**

## Homework

p.159 # 1,2,3 section review  
p.161 # 1 conceptual problem  
p.163 # 1,2,3 practice problems  
p.179 # 1,2 (not numbered)

You will find it helpful to read parts of p.154 to p.179 to find some of these answers.

